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A Novel Approach Traffic Control System for Congestion Control, Ambulance Clearance, and Stolen Vehicle Detection

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Abstract: A green wave on a road with a series of coupled signalized intersections enables a driver to pass each traffic light at green light. The Green wave systems are most suitable to provide clearance to emergency vehicles during rush hours many systems are used to implement the green wave systems. We have developed a cost effective system using Radio frequency identification (RFID) Technology Global system for mobile communication (GSM) modules and latest high speed microcontrollers to achieve the desired results. The primary objective is to identify the emergency vehicle and track its location so that we can provide a green wave to the emergency vehicle. To alleviate congestion public transport can be improved or the Infrastructure can be expanded. In urban areas, the latter is often infeasible due to residential Areas adjacent to the existing roads.

Keywords: Green wave, low cost, Emergency Vehicle Clearance, tracking, detection of stolen vehicles.

1. INTRODUCTION

In today's world, traffic jams during rush hours is one of the major concerns. During rush hours, emergency vehicles like Ambulances, Police cars and Fire Brigade trucks get stuck in jams. Due to this, these emergency vehicles are not able to reach their destinations in time, resulting into a loss of human lives. We have developed a system which is used to provide clearance to any emergency vehicle by turning all the red lights to green on the path of the Emergency vehicle, hence providing a complete green wave to the desired vehicle. A 'green wave' is the synchronization of the green phase of traffic signals. With a 'green wave' setup, a vehicle passing through a green signal will continue to receive green signals as it travels down the road. Around the world, green waves are used to great effect.

Often criminal or terrorist vehicles have to be identified. In addition to the green wave path, the system will track a stolen vehicle when it passes through a traffic light. A more intricate way to improve the network Performance is to make better use of the existing roads. Traffic signals are employed in urban areas in order to control traffic flows and avoid Collisions by fairly distributing the right-of-way for adjoining road segments and to ensure a smooth flow of traffic. A green wave occurs when a series of traffic lights (usually three or more) are coordinated to allow continuous traffic flow over.

Several intersections in one main direction: Traffic congestion has significant detrimental impacts on the economy, environment and quality of life of the community as evidenced by 1. Increase in transportation costs associated with road and freight tasks, which negatively effects national productivity and competitiveness. 2. Increased CO2 emissions from vehicles, due to increased idle time. 3 .The public discontent about the lack of effective traffic management as destination travel time is increased.

Green wave:
A green wave is a term for when drivers get green light at coupled signalized intersections so a continuous traffic flow occurs. Drivers in a green wave will not have to stop for red light at signalized intersections. In order to make use of a green wave the driver has to drive a given speed. This can be a fixed speed or a variable speed. With a fixed speed one is able to make use of a green wave driving always the same speed. This speed can be given to the drivers by traffic signs at the roadside.

The variable speed can depend on vehicle-actuated traffic lights where the control strategy of the traffic lights is adjusted to the amount of traffic. Not all traffic will always be able to get a green wave because the green phase is not infinite. So it is possible that drivers do have to wait. A green wave can reduce noise emission and also energy consumption because of less need for acceleration and deceleration. The environment and the safety and through-put on the road network will also benefit from a green wave. A green wave can be disturbed by slow traffic of traffic speeding.

An adaptive control system can overcome this inefficiency using real-time sensor data on traffic lights, which can account for the delay time by measuring the inflow and outflow of vehicles through an intersection.

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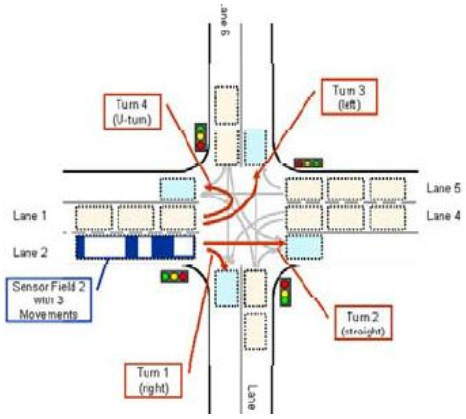
Dynamic systems which link traffic light signals is possible with the use of area traffic control systems (ATCSs) that use algorithms to interconnect complex intersections. The main advantage of the green wave traffic signal optimization arises with the consistent flow of traffic, resulting in the reduction of congestion from stopping and starting in addition to wasteful energy and emissions. Results from a case study in Manchester, showed that there was a 7.6% decrease in CO2 emissions and more significantly, a 35.2% reduction in journey time compared to an unsynchronized network.

The application domain of this proposal is distributed traffic intersection traffic-light control. Globally the volume of road traffic increases every single day, as does correspondingly the volume of consumed energy resources and emitted pollutants. Many counter measures seek means to reduce the volume of vehicles, but our approach reduces overall traffic congestion, and thus stolen vehicles, emergency vehicle, normal by increasing the throughput of vehicles crossing town and city networks. We achieve this with real-time vehicle tracking and monitoring serving as input to goal-driven agents controlling the phase-change of intersections, rather than the standard sequential model deployed universally today.

II. EXISTING METHODS

1. Image processing:
Conventional technologies use image processing systems to identify the emergency vehicle. But these systems have a drawback during bad weather conditions. Due to wind, rain, fog, etc., the image received by the camera is distorted by noise and it becomes difficult for the system to identify the desired vehicle. Thus, we have built our system using RFID transponders and readers. The advantage of RFID is that it is a cost effective system which will provide uninterrupted communication in our network even in bad weather conditions.

2. Video camera:
Vehicle detection sensors consist of induction loops embedded in the road surface and video cameras installed in strategic locations to monitor traffic entering and passing through intersections.



Experiments have been conducted with data from real sensors, but for the purposes of demonstration we simulate both induction and video sensors within the SUMO environment. Video sensors are critical to our approach as they allow the tracking of vehicles through an intersection from point of ingress to point of egress. Vehicles are not identified and individually tracked, but rather treated as statistical entities.

III.PROPOSED EMBEDDED SYSTEM DESIGN:

This proposed system consisting of, RFID-Radio Frequency identification system, GSM-global subscriber module, GPS-global position system, vehicle detection system –stolen vehicle detection, emergency detection, normal vehicle detection, fire detection.

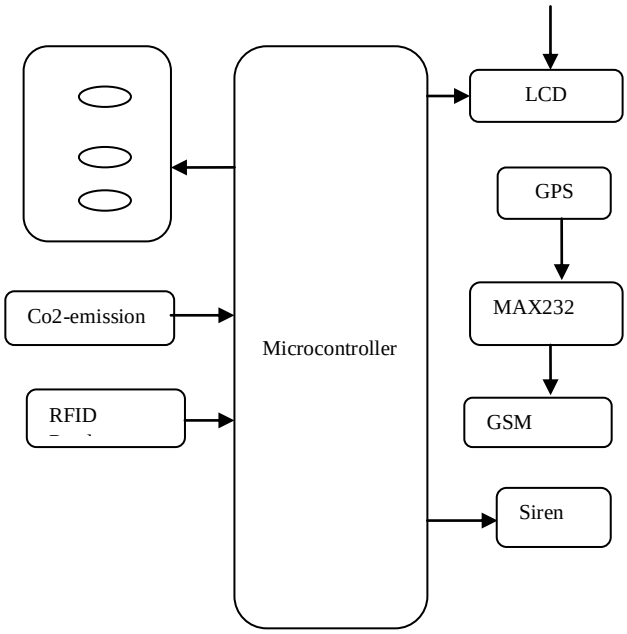


Fig.1. Proposed Embedded System Design

Some researchers have tried to monitor the behavior of the vehicle or the driver in isolation, while others have focused on monitoring a combination of the driver, the vehicle and the environment, so as to detect the status of the driver in an attempt to prevent road accidents. However, there is still no comprehensive system that can effectively monitor a driver's behavior, the vehicle's state and environmental changes to perform effective reasoning regarding uncertain contextual information (driver's behavior), so as to alert other vehicles on the road by disseminating warning messages in time to the relevant vehicles in the vicinity, including implementing practical corrective actions to avoid accidents.

The driver behavior detection systems described above focus on the detection of driver's status (drunk, affected by fatigue, drowsy) by monitoring the driver or the vehicle and issuing warning messages to the driver to prevent road accidents. Whilst these systems have achieved good results in terms of improving road safety, they are limited

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to alerting the driver or controlling the vehicle itself. Moreover, they have not considered the behavior of the driver as a high-level context (uncertain context).

This study attempts to construct a comprehensive system that is able to detect normal and abnormal driving behavior using a context-aware system to collect and analyse contextual information about the driver, the vehicle's state and environmental changes and to perform reasoning about certain and uncertain context. The driver and other vehicles are then alerted by operating an in-vehicle alarm and sending warning messages containing corrective actions via wireless technology using GSM and GPS, accident location, send the information to concerned persons.

Traffic Monitoring:
All the information of the vehicles passing through the junctions is also stored in the system database, which could be used at a later stage for traffic monitoring and other purposes.

Update of database dynamically through SMS:
The database of the system is connected with the GSM Module, so, the information regarding the category and priority of vehicles can be easily updated in seconds through a Short Messaging Service (SMS).

Priority of Vehicle:
There are three levels of the priority of the vehicle defined in the system namely low, high and highest. For stolen vehicles the priority is set as 'T'.

Categories:
The system has three predefined categories of vehicle Namely, normal vehicle, stolen vehicle and emergency vehicle. These categories can be changed as per the requirements. The updating of the priority can be done dynamically with the help of the GSM module as shown in the system structure block diagram.

IV. RESULTS AND CONCLUSION

The program was successfully burned on the micro-controller using USB programmer and when an emergency vehicle approaches this reader, it is successfully detected by the system as an emergency vehicle and traffic light module is activated. On the other hand, if any stolen vehicle is detected, it is displayed on the LCD. The system is efficient. This prototype presents a novel solution to implement the concept of green wave in urban cities. The overall system is quite cost effective and has various advantages over the conventional technologies.

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